What is claimed is:

1. An active ion-doped waveguide-plasmon resonance (AID WPR) sensor for analyzing a sample placed adjacent to a conductive thin film, comprising

a conductive thin film for providing surface plasmons;

a dielectric medium disposed at one side of the conductive thin film;

a light source for emitting an incident light beam to the conductive thin film through the dielectric medium;

a dielectric thin film doped with active ions capable of fluorescing by being excited with the incident light beam, the dielectric thin film deposited at the surface of the conductive thin film opposite to the dielectric medium to act as an waveguide of surface plasmon waves and having a surface on which a sample is immobilized; and

a photodetector for receiving and determining the intensity of fluorescence from the active ions.

2. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the photodetector determines a change in refractive index of the sample from the intensity of fluorescence quantify and qualify the sample or to determine the thickness of the sample.

3. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the light source emits a transverse magnetic (TM) polarized light or transverse electric (TE) polarized light as the incident light beam.

4. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the light source emits a laser beam as the incident light beam.

5. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the conductive thin film is formed of one material selected from the group consisting of Au, Ag, Cu, Si, and Ge.

6. The active ion-doped waveguide-plasmon resonance sensor of claim 5, wherein the conductive thin film has a thickness of 35-50 nm.

7. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the conductive thin film is deposited on a bottom surface of the glass substrate, and the dielectric medium is disposed on top of the glass substrate.

8. The active ion-doped waveguide-plasmon resonance sensor of claim 7, further comprising a Cr layer or Ti layer to increase adhesion between the conductive thin film and the glass substrate.

9. The active ion-doped waveguide-plasmon resonance sensor of claim 7, further comprising an index matching oil layer between the glass substrate and the dielectric medium.

10. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the photodetector is one selected from the group consisting of photodiode, photomultiplier, charge coupled device, and photosensitive sheet.

11. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the dielectric medium is a trapezoidal prism.

12. The active ion-doped waveguide-plasmon resonance sensor of claim 1, further comprising an optical filter to increase the purity of the fluorescence from the active ions and received by the photodetector.

13. The active ion-doped waveguide-plasmon resonance sensor of claim 1, further comprising a lens for condensing the fluorescence from the active ions toward the photodetector.

14. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the incident light beam is incident onto the conductive thin film at a fixed incident angle.

15. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the dielectric thin film is formed of a layer selected from the group consisting of SiO_2 layer, Al_2O_3 layer, TiO_2 layer, Ta_2O_5 layer, MgF_2 layer, Y_2O_3 layer, TeO_2 layer,

PbO layer, LaF_3 layer, ZnS layer, $ZnSe$ layer, Si_3N_4 layer, AlN layer, or a composite layer of these layers.

16. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the active ions are derived from one selected from the group consisting of transition metal, rare-earth element, and organic dye.

17. The active ion-doped waveguide-plasmon resonance sensor of claim 16, wherein the active ions have the ability to fluoresce by emitting light of a shorter wavelength than the incident light beam through two-photon or three-photon absorption.

18. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the active ions are selected from the group consisting of Tm^{3+} ions, Er^{3+} ions, Yb^{3+} ions, Ho^{3+}-Yb^{3+} composite ions, Tm^{3+}-Yb^{3+} composite ions, Er^{3+}-Yb^{3+} composite ions, and Tm^{3+}-Nd^{3+} composite ions.

19. The active ion-doped waveguide-plasmon resonance sensor of claim 1, wherein the active ions are Tm^{3+} ions and fluoresce light of a 350-nm wavelength by excitation with the incident light beam of a 650-nm wavelength.

20. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the active ions are Er^{3+} ions and fluoresce light of a 550-nm wavelength by excitation with the incident light beam of a 800-nm wavelength.

21. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the active ions are Yb^{3+} ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

22. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the active ions are Ho^{3+}-Yb^{3+} composite ions and fluoresce light of a 550-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

23. The active ion-doped wavelength-plasmon resonance sensor of claim 1,

wherein the active ions are Tm^{3+}-Yb^{3+} composite ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

24. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the active ions are Er^{3+}-Yb^{3+} composite ions and fluoresce light of a 550-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

25. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the active ions are Tm^{3+}-Nd^{3+} composite ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 800-nm wavelength.

26. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the dielectric thin film is thick enough to produce a coupled plasmon-waveguide resonance mode and attenuated total reflection leaky mode coupled to surface plasma resonance.

27. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the dielectric thin film has a thickness of 100-700 nm.

28. The active ion-doped wavelength-plasmon resonance sensor of claim 1, wherein the sample is liquid, and the active ion-doped wavelength-plasmon resonance sensor further comprises a sample holder and a pump for sample circulating.

29. An active ion-doped wavelength-plasmon resonance imaging system for imaging a sample placed adjacent to a conductive thin film, the imaging system comprising:

conductive film arrays for providing surface plasmons;

a dielectric medium disposed at one side of the conductive film arrays;

a light source for emitting an incident light beam to the conductive film arrays through the dielectric medium;

dielectric film arrays doped with active ions capable of fluorescing by being excited with the incident light beam, the dielectric thin film deposited at the surface of the conductive film arrays opposite to the dielectric medium to act as an waveguide of surface plasmon waves and having a surface on which a sample is immobilized; and

a photodetector for receiving the fluorescence from the active ions and imaging the sample from fluorescent intensity variations between each conductive film array.

30. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the photodetector is one selected from the group consisting of photodiode, photomultiplier, charge coupled device, and photosensitive sheet.

31. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the light source emits a transverse magnetic (TM) polarized light or transverse electric (TE) polarized light as the incident light beam.

32. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the light source emits a laser beam as the incident light beam.

33. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the conductive thin film is formed of one material selected from the group consisting of Au, Ag, Cu, Si, and Ge.

34. The active ion-doped waveguide-plasmon resonance imaging system of claim 33, wherein the conductive film arrays have a thickness of 35-50 nm.

35. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the conductive film arrays are deposited on a bottom surface of the glass substrate, and the dielectric medium is disposed on top of the glass substrate.

36. The active ion-doped waveguide-plasmon resonance imaging system of claim 35, further comprising a Cr layer or Ti layer to increase adhesion between the conductive film arrays and the glass substrate.

37. The active ion-doped waveguide-plasmon resonance imaging system of claim 35, further comprising an index matching oil layer between the glass substrate and the dielectric medium.

38. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the dielectric medium is a trapezoidal prism.

39. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, further comprising an optical filter to increase the purity of the fluorescence from the active ions and received by the photodetector.

40. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, further comprising a lens for condensing the fluorescence from the active ions toward the photodetector.

41. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the incident light beam is incident onto the conductive film arrays at a fixed incident angle.

42. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the dielectric thin film is formed of a layer selected from the group consisting of SiO_2 layer, Al_2O_3 layer, TiO_2 layer, Ta_2O_5 layer, MgF_2 layer, Y_2O_3 layer, TeO_2 layer, PbO layer, LaF_3 layer, ZnS layer, ZnSe layer, Si_3N_4 layer, AlN layer, or a composite layer of these layers.

43. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the active ions are derived from one selected from the group consisting of transition metal, rare-earth element, and organic dye.

44. The active ion-doped waveguide-plasmon resonance imaging system of claim 43, wherein the active ions have the ability to fluoresce by emitting light of a shorter wavelength than the incident light beam through two-photon or three-photon absorption.

45. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the active ions are selected from the group consisting of Tm^{3+} ions, Er^{3+} ions, Yb^{3+} ions, Ho^{3+}-Yb^{3+} composite ions, Tm^{3+}-Yb^{3+} composite ions, Er^{3+}-Yb^{3+} composite ions, and Tm^{3+}-Nd^{3+} composite ions.

46. The active ion-doped waveguide-plasmon resonance imaging system of claim 29, wherein the active ions are Tm^{3+} ions and fluoresce light of a 350-nm wavelength by excitation with the incident light beam of a 650-nm wavelength.

47. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Er^{3+} ions and fluoresce light of a 550-nm wavelength by excitation with the incident light beam of a 800-nm wavelength.

48. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Yb^{3+} ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

49. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Ho^{3+}-Yb^{3+} composite ions and fluoresce light of a 550-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

50. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Tm^{3+}-Yb^{3+} composite ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

51. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Er^{3+}-Yb^{3+} composite ions and fluoresce light

of a 550-nm wavelength by excitation with the incident light beam of a 980-nm wavelength.

52. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the active ions are Tm^{3+}-Nd^{3+} composite ions and fluoresce light of a 480-nm wavelength by excitation with the incident light beam of a 800-nm wavelength.

53. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the dielectric thin film is thick enough to produce a coupled plasmon-waveguide resonance mode and attenuated total reflection leaky mode coupled to surface plasma resonance.

54. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the dielectric thin film has a thickness of 100-700 nm.

55. The active ion-doped wavelength-plasmon resonance imaging system of claim 29, wherein the sample is liquid, and the active ion-doped wavelength-plasmon resonance sensor further comprises a sample holder and a pump for sample circulating.